

# PATENT SPECIFICATION

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DRAWINGS ATTACHED.

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## COMPLETE SPECIFICATION.

### Improved Method and Apparatus for Extruding Hollow Bodies.

I, ORESTE FLAVIO ALFREDO BIGINELLI, of French nationality, of 22 rue Buffon, Clermont Ferrand (Puy de Dome), France, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to an improved method of and apparatus for extruding a hollow body, more particularly a hollow body or case having thick walls and an internal comparatively thin base.

In order to obtain hollow bodies such as cases or the like, it is already known to use extrusion methods in which a solid billet is pressed into a female die by means of a ram in such a manner that the material of the said billet is forced back about the ram in the direction opposite to the displacement of said ram, in order to form a skirt of cylindrical shape.

The known apparatus for carrying such methods into effect have many disadvantages, and more particularly do not make it possible to obtain hollow bodies having a thin bottom end and thick walls.

Indeed, in the known methods, after the hollow body or case has been extruded in the female die the said case has to remain held in the said die in order to permit release of the ram: an extracting ram arranged on the upper portion of the female die is then used to eject the said case. When it is desired to construct a thin bottom end when using this method, the case, after extrusion is detached from the walls of the female die and follows the ram as the latter descends. Since the said case does not, however, encounter and extracting means it remains fast with the ram, which causes serious difficulties in the matter of extraction.

An object of the present invention is to obviate the foregoing disadvantages. Accordingly the invention provides a method of extruding a hollow body having a side wall and integral base, including the steps of placing a billet in a conical female die, advancing a ram into said die to extrude said billet into a partially formed hollow body having an external shape corresponding to the internal shape of the female die and a wall and base of substantially the same thickness, continuing the advance of said ram further to reduce the base thickness and to deform said body whereby the wall thereof tends to detach from the wall of the female die, withdrawing the ram with the extruded hollow body thereon and ejecting said body from the ram.

According to a further aspect of the invention there is provided an apparatus for carrying out this method including a conical female die, for accommodating a billet, and a co-operating extrusion ram arranged to enter the die, the leading end of said ram being shaped so as to deform the hollow body when the base thickness thereof is reduced whereby the body wall is detached from the die and the body becomes entrained on the ram for withdrawal therewith from the die.

The apparatus may further include a travel-limiting stop means arranged to co-operate on the one hand with the die and on the other hand with a press housing the ram, whereby the thickness of the base of the hollow body can be determined.

The invention will now be described with reference to the accompanying drawings, in which:—

Figure 1 is a sectional view of an apparatus for carrying out the method of the invention shown during one stage of the operation thereof;

Figure 2 is a view similar to Figure 1, showing the apparatus in a second stage of operation;

Figure 3 is a view similar to Figures 1 and 2 showing the apparatus in a further stage of operation; and

Figure 4 is a similar view of the apparatus showing a still further stage of operation.

Referring now to the drawings, Figure 1 shows a billet 1 positioned in an inverted conical female die 2 and maintained therein under the action of a ram 3 which is centered by axially movable guiding and ejecting means 4 of sleeve-like form. After the billet 1 has been positioned in the die 2, the ram 3 is actuated to bear on the said billet. The ram 3 is guided and centered in the body of a press 5 and also in a bore 6 of the female die 2 by the guiding and ejecting means 4 to permit accurate centering of the said ram when the billet is being extruded.

In the extruding phase or stage the billet 1 initially forms a hollow body or case of regular form, the outer walls of which correspond to the form of the female die, inasmuch as the side walls and the bottom of said case or body are of equal thickness. As the extrusion progresses, the ram 3 continues to ascend in order to carry out the thinning of the bottom end 1<sub>2</sub> of the hollow body, the latter is deformed and this tends to detach the walls 1<sub>1</sub> of the said case or body from the walls of the female die 2 as shown in Figure 2.

During the extrusion effected by the ascent of the ram 3 within the female die 2, the walls 1<sub>1</sub> of the case or hollow body flow in the direction opposite to the advance of the ram, causing the displacement of the guiding and ejecting means 4 in the direction opposite to the advance of the said ram.

During the stage when the bottom end 1<sub>2</sub> of the hollow body is formed, the body of the press 5 comes to bear against the lower face of the female die 2 through the intermediary of a travel-limiting stop means 7 which co-operates on the one hand with the female die 2 and on the other hand with the mounting of the ram 3. By adjusting the thickness of the said means 7, it is thus possible to determine precisely the constant thickness of the bottom 1<sub>2</sub> of the hollow body which is formed.

During this extrusion stage, and more particularly during the formation of the bottom end 1<sub>2</sub> of the hollow body, the walls 1<sub>1</sub> of the said hollow body are detached from the walls of the female die 2 owing to the shape of the leading end of the ram 3. The hollow body is then removed from the die 2 and, as shown in Figure 3, since the hollow body no longer adheres to the walls of the said die 2, when the ram 3 of the press is

made to descend the hollow body follows the descent of the said ram 3.

The remaining stage in the process is the ejection of the hollow body from the apparatus. In this stage, when the ram 3 of the press is at the bottom limit of its travel, the guiding and ejecting means 4, which can be driven either mechanically or hydraulically, is made to re-ascend relatively to the ram which remains fixed in position, thus ejecting the hollow body or case which has been formed.

When the guiding and ejecting means 4 is controlled hydraulically, a pressure medium is introduced at an inlet 8 in the body of the press which urges the guiding and ejecting means 4 to descend in the direction opposite to the advance of the ram. This makes it possible to place a billet on the end of said ram at the beginning of the extrusion process. The pressure is then released at the inlet 8 and a pressure is introduced at a further inlet 9 which urges the guiding and ejecting means 4 to re-ascend in the direction of advance of the ram towards the female die 2, in such a manner that an upper portion 4<sub>1</sub> of the said guiding and ejecting means 4 engages in the bore 6 of the female die, thus providing a guide for the billet and the ram during the entire extrusion stage.

When the extrusion is completed and the walls 1<sub>1</sub> of the case have pushed the guiding and ejecting means 4 in the direction opposite to the ascent of the ram and when the said ram arrives at the lower end of its descent, a hydraulic pressure is applied at the inlet 9 which urges the guiding and ejecting means 4 to re-ascend relatively to the ram 3, which is fixed in position, thus ejecting in a simple manner the case or hollow body which has been formed.

A hydraulic pressure is once more introduced at the inlet 8 and this urges the guiding and ejecting means 4 again to move downwards, whereupon the press assembly is ready to carry out a fresh extrusion cycle.

The female die 2 of the press advantageously includes a detachable base 2<sub>1</sub>, which can be replaced without having to replace the walls of the said female die.

The invention is not, of course, limited to the embodiment illustrated and described hereinbefore, and other variants and further forms of embodiment are possible within the scope of the accompanying claims.

#### WHAT I CLAIM IS:—

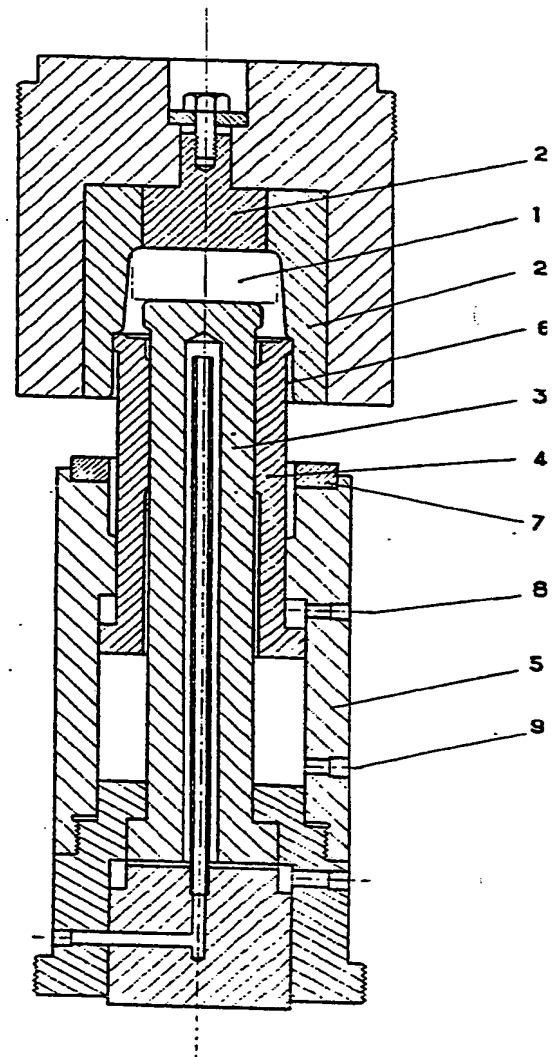
1. A method of extruding a hollow body having a side wall and integral base, including the steps of placing a billet in a conical female die, advancing a ram into said die to extrude said billet into a partially formed hollow body having an external shape corresponding to the internal shape of the female

- die and a wall and base of substantially the same thickness, continuing the advance of said ram further to reduce the base thickness and to deform said body whereby the wall thereof tends to detach from the wall of the female die, withdrawing the ram with the extruded hollow body thereon and ejecting said body from the ram.
2. An apparatus for carrying out the method claimed in Claim 1, including a conical female die, for accommodating a billet, and a co-operating extrusion ram arranged to enter the die, the leading end of said ram being shaped so as to deform the hollow body when the base thickness thereof is reduced whereby the body wall is detached from the die and the body becomes entrained on the ram for withdrawal therewith from the die.
3. An apparatus according to Claim 2, including ejecting means surrounding said ram and reciprocal along the length thereof to eject the hollow body from the ram after withdrawal from said die.
4. An apparatus according to Claim 3, wherein the ejecting means is arranged to guide and centre the ram within the die on advance of said ram.
5. An apparatus according to any of Claims 2 to 4, including a travel-limiting stop means arranged to co-operate on the one hand with the die and on the other hand with a press housing the ram whereby the thickness of the base of the hollow body can be determined.
6. An apparatus according to any of Claims 3 to 5, characterised in that the ejecting means is controlled mechanically.
7. An apparatus according to any of Claims 3 to 5, characterised in that the ejecting means is controlled hydraulically.
8. An apparatus according to any of Claims 2 to 7, characterised in that the female die includes a detachable base.
9. A method of extruding a hollow body substantially as hereinbefore described.
10. An apparatus for extruding a hollow body substantially as hereinbefore described with reference to the accompanying drawings.

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Fig. 1



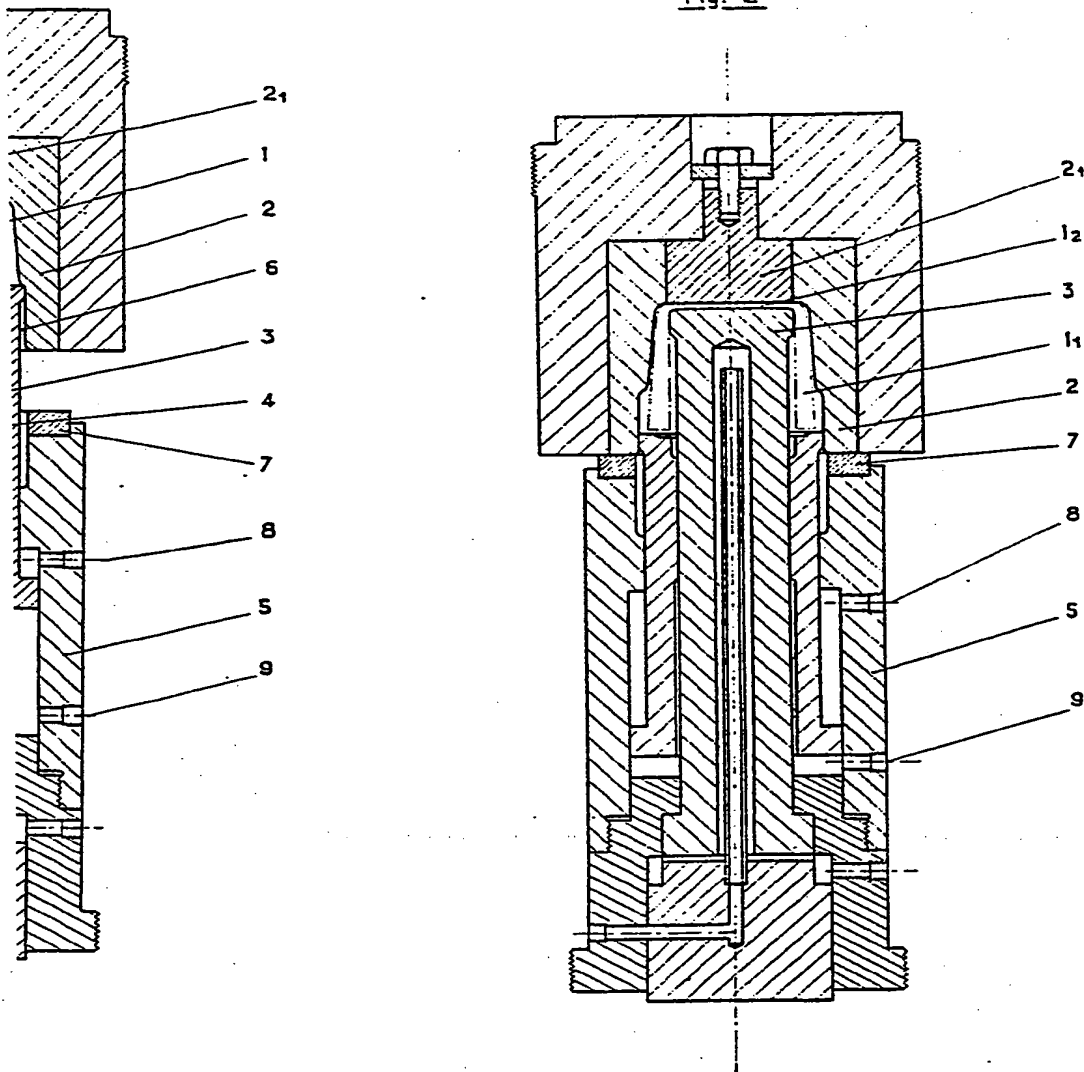
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Fig. 2



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 Sheets 1 & 2

Fig. 1

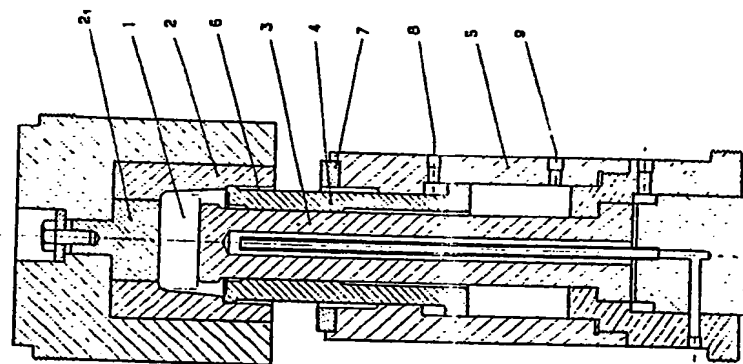
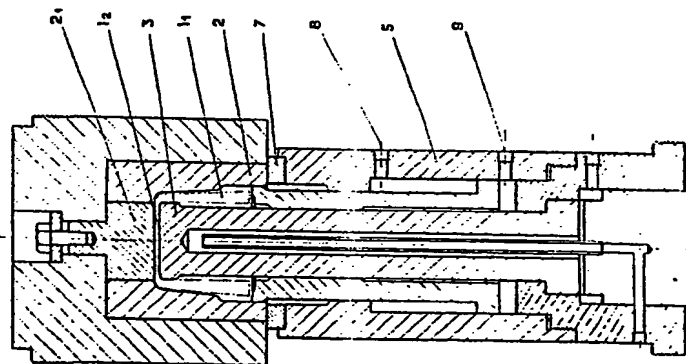


Fig. 2



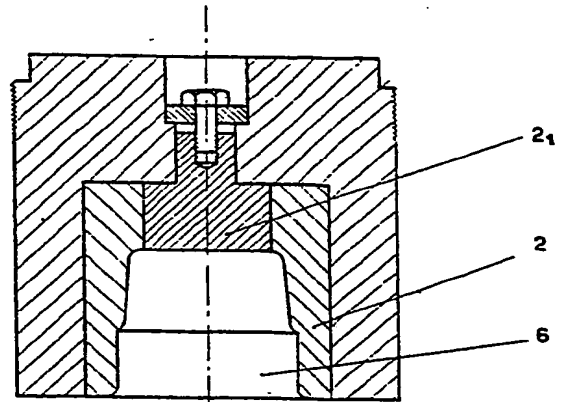
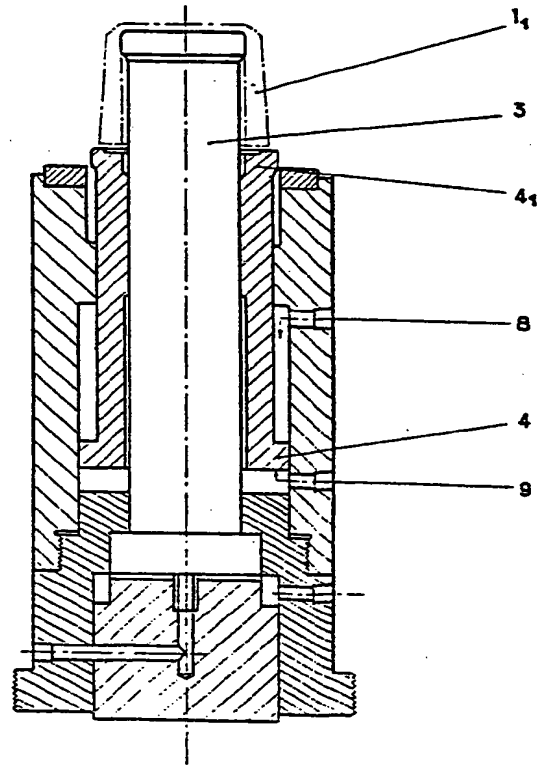


Fig. 3



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Sheets 3 & 4

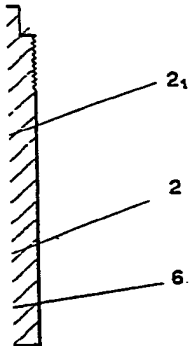
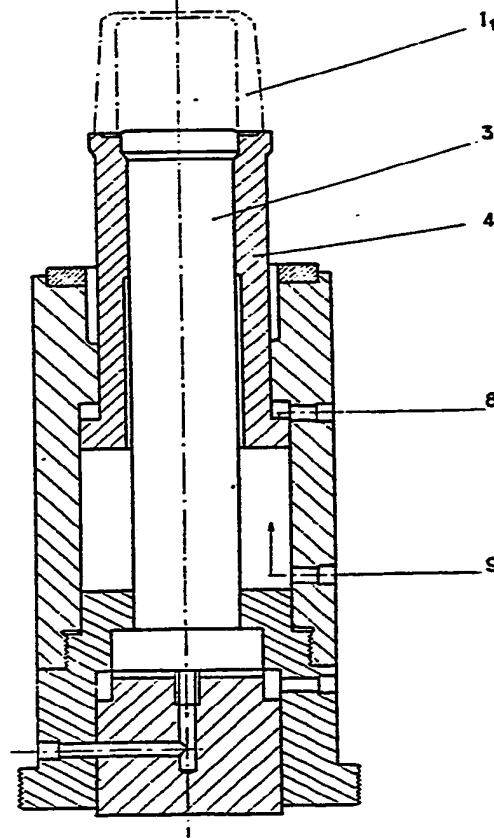
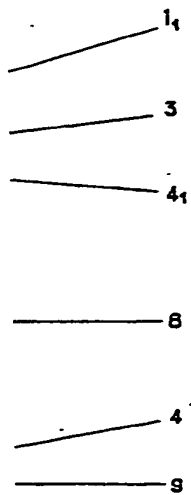
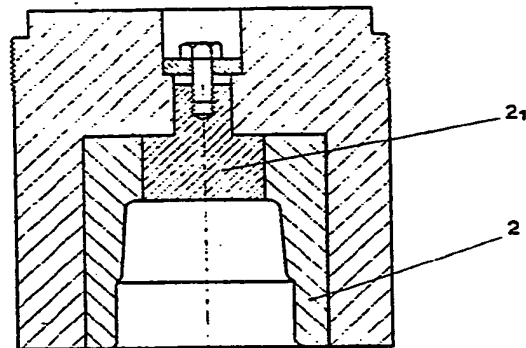


Fig. 4





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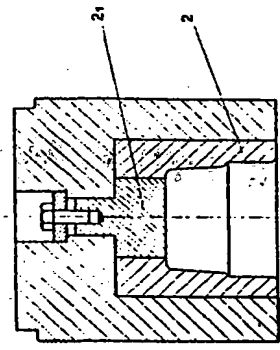


Fig. 4

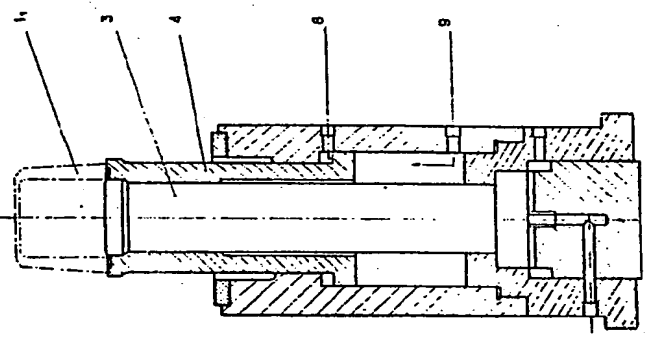
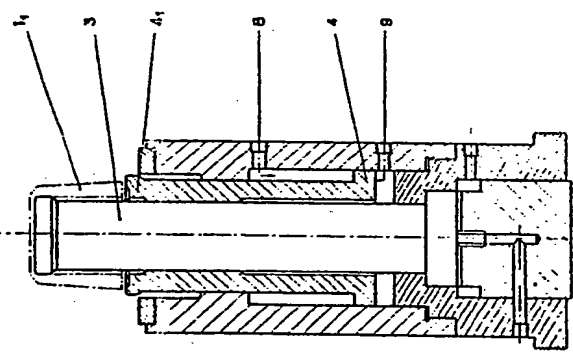
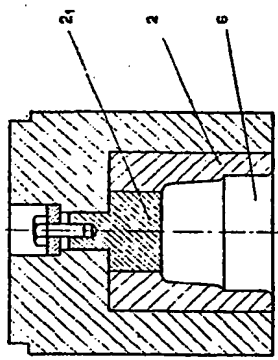


Fig. 3



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